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Laterality, Perception, and Action during the Size-weight Illusion

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Introduction

In the classic **size-weight illusion** (SWI), a small object will feel heavier than an larger object of equal weight (Charpentier, 1891). Individuals continue to perceive this illusory difference in weight long after their gripping and lifting forces have scaled to the actual, identical, mass of the illusion-inducing stimuli (Flanagan & Beltzner, 2000).

The independence of our weight perception and fingertip force application has only been quantified in the right hand of right-handers. The immunity to this perceptual illusion may be affected by manual asymmetries (e.g., Gonzalez , Ganel, & Goodale, 2006).

We examined perception of heaviness and fingertip force scaling in right- and left-handers during repeated lifts of SWI-inducing cubes with their dominant and non-dominant hands.

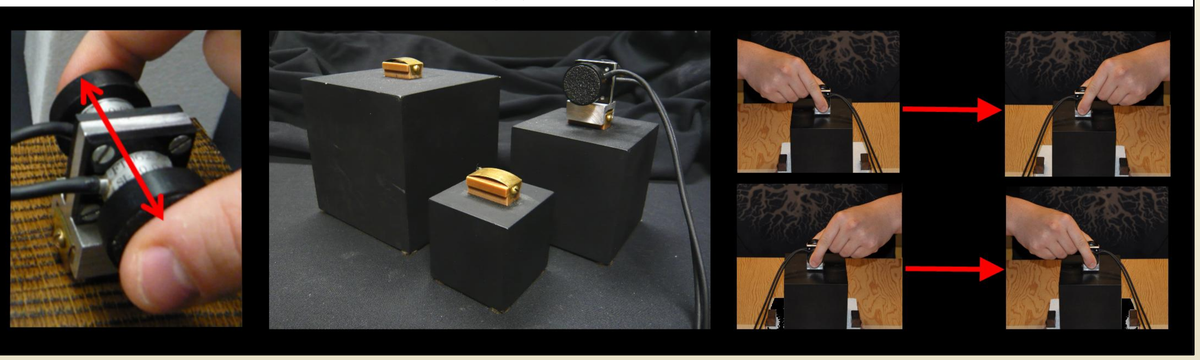
We also examined the optimal direction for intermanual transfer of the scaled fingertip forces.

Materials & methods

30 left-handers and 30 right-handers participated. Half of the subjects were told to lift with their left hand first, and the other half were told to lift with their right hand first.

Participants then reached out and lifted one of the 3 identically-weighted (700g) SWI cubes with a precision grip on a handle. After 45 such lifts (15 per cube, randomly ordered), participants were given a short break. Participants then completed a further 45 lifts with their other hand.

Numerical heaviness ratings were given by participants on every trial, and the force transducer mounted within the handle recorded their grip forces.



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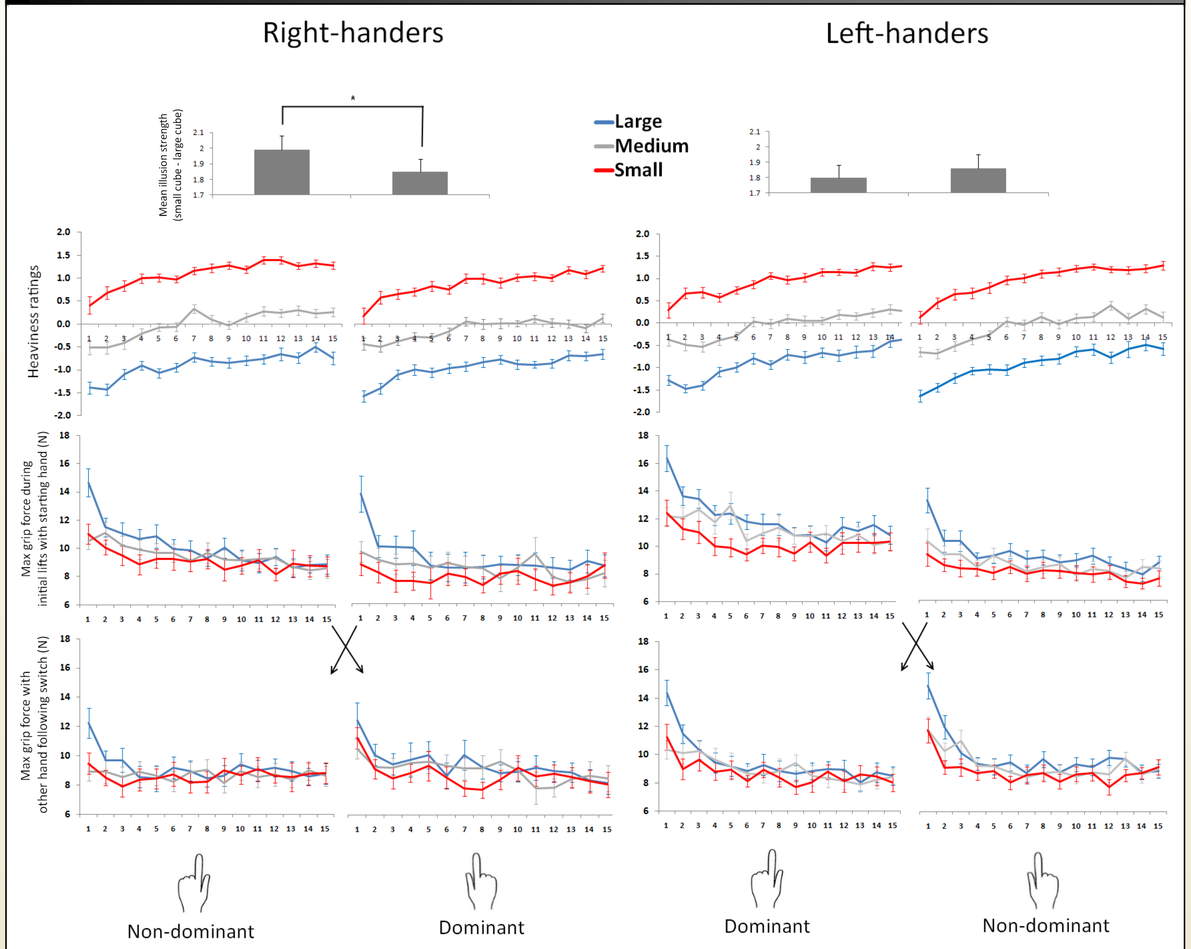
Results



- **Larger left hand illusion.**
- **Poorer right hand grip force scaling.**
- **Better transfer going from the left to right hand.**

- **Both hands show an equally strong illusion.**
- **Poorer left hand grip force scaling.**
- **Equal transfer in either direction.**

Discussion

Larger left hand SWI may indicate a dominant hand advantage for weight perception, but in right-handers only.

Poorer dominant hand scaling suggests that the lifts with the preferred hand rely more on consistently-reinforced, and usually effective, priors (e.g., large items will outweigh small items).

Intermanual transfer asymmetry implies that dextrals' sensorimotor memory traces are lateralized to left motor areas. When right-handers lift with their non-dominant hand, both the left and right hemispheres are recruited, leaving residual traces for the untrained dominant hand to utilize.